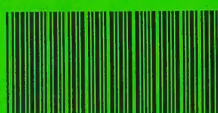


MP MASTER



MA24692

Instruction Manual

NOISE TUBE POWER UNIT - TYPE NM1
Serial No. 30.

NORE MICROWAVE

461, SOUTHCHURCH RD., SOUTHBEND-ON-SEA, ESSEX, ENGLAND

TEL. No. 66815

MICROWAVE NOISE STANDARDINSTRUCTIONS FOR USE

This Mount Type NTM.10/7L is designed for use with Nore Microwave Noise Tubes Type Vx 9247. The heater voltage of which is 6.3 at a current of .7A. The recommended anode current is 200 mA. The single pole socket should be connected, via the plug type UG.932A/U and the screened cable supplied, to the positive side of the Noise Tube Power Unit.

The twin pole socket should be connected via the plug type GD.072/POL and the twin core screened cable as follows:-

- (a) Outer screening - earth.
- (b) Large pin - 6.3v and negative side of the Noise Tube Power Unit.
- (c) Small pin - 6.3v supply.

Nore Microwave Noise Tube Power Unit type NM.1 is designed primarily for use with the Nore Microwave Noise Standards and it is recommended for use when the highest degree of accuracy is desired.

Insertion of Tube.

Care should be exercised when inserting the Noise Tube into the Mount since the shallow angle can permit the anode end of the tube to partially feed into the O/P wave guide section, which may result in fracture of the tube.

Due to the shallow angle of tube insertion, it may be found helpful if, when inserting the tube, a rotary action is employed together with a bias away from the keyway, until the cathode cap begins to enter. The tube should then be rotated to align the cathode cap key and then pushed home. When the tube is correctly seated the protrusion of cathode dowel will be about $\frac{1}{2}$ " for the NTM.10/7L and NTM.14/7L and about $\frac{3}{16}$ " for the NTM.16/7L. A special jig is supplied with the NTM.16/7L which should be inserted into the waveguide with the shorter side adjacent to the anode termination and pushed home until the end stop mates with the flange face. The tube can then be readily inserted. This mount is ~~not~~ fitted with absorbent loads (to ensure an excellent "cold" match over the operating band).

Noise Temperature

The equivalent noise temperature of this mount operating with the recommended tube at the recommended anode current and heater on is $\sim 9.900^{\circ}\text{K}$ ($\sim 15.2 \text{ dB} \pm .05 \text{ dB}$ above 290°K) at a frequency of 3 GHz. — SEE CALIBRATION (TO BE SUPPLIED)

NOTES:

1. The mount should be kept away from strong magnetic fields, (e.g. ferrite isolators, etc.) since these can cause a change in the Noise Power O/P.
2. Operation at less than 195 mA anode current is likely to result in fluctuations of noise output.
3. When using this noise source as a comparator, care should be taken to balance the lengths of waveguide run such that waveguide attenuation does not degrade the accuracy.
4. Warm-up period. A minimum period of 5 minutes should be allowed for tube warm-up, to ensure accuracy of noise measurement.
5. A further $\pm .10$ dB should be added to the noise output tolerance to allow for possible calibration inaccuracies. This will then give the variation about an absolute figure.

Issued by: NORE ELECTRIC CO. LTD.,
MICROWAVE DIVISION,
SOUTHCHURCH ROAD,
SOUTHEND-on-SEA,
ESSEX, ENGLAND.

MARCH, 1966.



I N D E X

	<u>P A G E</u>
Automatic Firing of Noise Tube	2
Capacitors - Parts List	8
Chassis layout top view (Y)	18
Chassis layout lower view (X)	19
Circuit diagram	Rear of folder
Cold Cathode Tube operation	5
Connectors - Parts List	10
Controls - Pre-set (Chassis mounted)	6
Control - Set 400c/s	6
Control - Set 1Kc/s	6
D.C.operation	3
Diodes, semi-conductor - Parts List	9
External current meter	4
External modulation	2 & 4
Front panel, rear view (Z)	17
Fuses - Parts List	9
General Operation	1
Inductors	10
Initial checks (Prior to switch on)	3
Internal voltage measurement	5
Mark/space ratio	6
Metering	4
Miscellaneous - Parts List	11
Modulation	1
Monitoring facility	4
Neon filled Noise Tube operation	5
Operating Instructions	3
Parts List: Capacitors	8 & 9
Connectors	10
Diodes, semi-conductor	9
Fuses	9
Miscellaneous	11
Pilot lamp	10
Relays	10
Resistors (Fixed)	7 & 8
Resistors (Variable)	8
Semi-conductor diodes	9
Sockets	10
Switches	10
Thermal delay	10
Transformers	10
Valves	9

	<u>P A G E</u>
Pilot Lamp - Parts List	10
Pre-set controls	6
Pulse operation	3
Relays - Parts List	10
Resistors (Fixed) - Parts List	7 & 8
Resistors (Variable) - Parts List	8
Replacement Parts - suppliers of -	12
Rotary switch detail	20
Semi-conductor diodes - Parts List	9
Set 400c/s control	6
Set 1Kc/s control	6
Sockets - Parts List	10
Stabilisation of current	1
Suppliers of Replacement Parts	12
Switches - Parts List	10
Synchronisation	4
Tag Panel 1	13
Tag Panel 2	14
Tag Panel 3	15
Tag Panel 4	16
Tag Panel 5	16
Tag Panel 6	16
Thermal Delay	1
Thermal Delay - Parts List	10
Transformers - Parts List	10
Transformer connections	21
Tube Voltage measurement	5
Valves - Parts List	9
Voltage Circuit	22
Voltage table	5
Voltage Measurement - Internal	5
Voltage measurement - Tube	5

I N T R O D U C T I O N

This Instruction Manual describes the Power Unit type NM1 but the differences on the NM2 are fully accommodated as follows:-

Where Valves V.1. and V.2. are mentioned, V.11. will be in parallel, similarly on current setting VR.8 will operate as per VR.1, 2 and 3.

In addition to this the following changes are incorporated and are shown on the Parts List and Circuit Diagram.

1. Meter shunts, series resistors and calibration differ.
2. Addition of resistor chain R.63, VR.8 and R.64 for setting of 300mA current range.
3. The addition of V.11 in parallel with V.1. and V.2. and associate resistors R.65, R.66 and R.67.
4. The addition of R.68 and S.2C for stabilizing reference on 300mA range.

G U A R A N T E E

Nore Microwave Guarantees each instrument manufactured by them to be free from defects in material and workmanship. Our obligation under this guarantee is limited to servicing or adjusting the instrument and to making good any defective parts thereof. Valves are guaranteed for three months, fuses and batteries are specifically excluded from any liability. This guarantee is effective for one year after delivery to the original purchaser, when the instrument is returned to our factory with transportation charges pre-paid, and when upon examination by the Company shall be found to be defective. If the fault has been caused by misuse or mishandling repairs will be charged at cost. In this event an estimate will be submitted before the work is started.

R E P A I R S

When returning instruments for repair, or for any other reason, please contact the Company for shipping instructions. To expedite repair service, it is important to provide type number, serial number and a detailed description of the reason for the return of the instrument.

C H A N G E S

Because we have a programme of continuous product improvement, specifications noted herein are necessarily subject to change without notice. The Company also reserves the right to make changes in design without incurring any obligation to make the same changes in units previously ordered or to continue the production of instruments conforming to former designs.

NORE MICROWAVE

NOISE TUBE POWER UNITS TYPE NM1 AND NM2

1. Circuit Description

(a) Thermal delay

The thermal delay on this unit is designed to switch the supply of T.1. (H.T.transformer) whilst the heater transformer T.2 is switched on by the mains switch S.6. This delay, therefore, allows sufficient time for the valves and noise tube to warm up prior to the application of H.T.

The circuit includes a relay RL.2, the change over contacts of which are arranged to open circuit the bi-metal heater which allows the delay to cool and makes it readily available for further use should the unit be switched off and on again in rapid succession. This safety device gives maximum protection to the various capacitors and valves in the circuit.

(b) General operation

Regulator valves V.1 and V.2 have a separate screen supply derived from the 200-0-200V winding of T.1, F.1. rectified by D.1, D.2, D.3 and D.4, smoothed by R.1 and C.6. The negative line is connected to the regulator valve cathodes. V.1 and V.2 act as variable impedance series regulators, their control grids being fed from V5B anode, having R.16 as its load resistor.

Current is pre-set by VR1, 2 and 3 which are part of a potential divider across V.4 which ensures a constant voltage source: the voltage is fed from VR.1 etc., to grid 1 of V5A which controls the cathode current of this valve and hence the volt drop across R.24. This in turn establishes the bias on V5B thus setting the grid 1 voltage on regulator valves V.1 and V.2.

A separate -90V line stabilised by V.6 gives a reference potential for V.5 cathode about which the bias is varied. This -90V also serves to give a standing bias to grid 1 of V.9, which, under D.C. conditions, draws a constant low current from the noise tube supply line.

Stabilisation of current

Grid 1 of V5B is connected to a resistor (R31-33) which is in series with the noise tube, thus an increase in N/T current will cause a higher voltage to appear at V5B grid which will cause V5B to conduct more heavily thus reducing the potential at V5B anode, this in turn will reduce V1 and V2 grid voltage with respect to cathode, thus decreasing the current passed, giving an effective increase in series impedance. This will, in turn, reduce the N/T current and restore it to the original pre-set level.

Modulation

V.9 (EL360) is connected in parallel with the noise tube. Thus if this valve is caused to conduct heavily, the voltage at the noise tube anode will fall to a value below the maintaining voltage of the Noise Tube. This will cut off the Noise Tube current which will not be restored until a high voltage appears, which is capable of striking the Noise Tube. This voltage is derived by cutting off V.9 rapidly, which will cause a large back e.m.f. to be

developed across L.1 with respect to the common line.

Considering the onset of one modulation pulse, the following sequence of events takes place:-

V.9 conducts heavily thus lowering the current available for the Noise Tube, which, in turn, will increase the maintaining voltage of the Noise Tube, causing it to cut off. V.9 then draws the full current which was previously taken by the Noise Tube, thus maintaining a constant voltage drop across the sensing resistor R.31, R.32 or R.33 (dependant on current range in use). At the trailing edge of a square wave modulation pulse the voltage on V.9 grid is rapidly reduced thus cutting off V.9 which produces the back e.m.f. through L.1 as before.

A multi-vibrator V.7 a and b has two pre-set frequencies of 400 c/sec or 1Kc/sec set by VR.6 or 7 respectively. The O/P of this stage is fed via C.14 to the flip-flop circuit V.10 a and b (Monostable); the mark/space ratio of which is adjustable by VR.5. The O/P of the flip-flop is connected via C.12 to the grid of V8B amplifier. This amplifier O/P is coupled via C.10 and switch S3C to grid 1 of V.9 (Modulator valve) which then functions as a continuous pulse modulator.

The multi-vibrator can be synchronised to an external unit by the application of a synchronising pulse via SKT.5 and C.18 to grid 1 of V8A which is connected as a cathode follower, the load resistor R.60 being returned to the -90V stabilised line.

The O/P of V8A is coupled by C.15 to cathode of V7a which will be triggered by the I/P pulse. The polarity of the pulse of current through the Noise Tube will be the same as that of the I/P pulse.

External modulation

A signal connected to the external modulation socket (SKT.7) is fed via a two stage amplifier V.12 a and b, and S.3E to grid 1 of the monostable flip-flop V.10. Thus when S.3 is in the appropriate position the internal multi-vibrator is disconnected and the Noise Tube modulated by the externally generated wave form, the mark/space ratio of which is determined by the setting of the front panel control. (VR.5)

Automatic Firing of Noise Tube.

This is accomplished by switching the square wave derived from multi-vibrator V.7 a and b via mark/space ratio control flip-flop circuit V.10 a and b and pulse amplifier V8B to the grid of V.9 (modulating valve).

This behaves in the manner described in the preceding paragraph (Modulation) until such time as the appropriate high voltage pulses cause the tube to strike. Once this occurs the voltage across the operating coil of RL.1 rapidly falls and de-energises RL.1 contacts 1 and 2 which removes the H.T. from the multi-vibrator V.7 and associate valves V.8, 10 and 12 and open circuits the line between V.8B anode and V.9 grid. The tube then continues to operate on D.C. condition.

Note

If ext. monitoring jack is used, a current path must be provided through it

2. Operating Instructions

A. Before switching on:

- (a) Check that your mains supply is 240v A.C. Unless otherwise specified the unit is adjusted for operation on 240v A.C. mains. If your mains supply differs substantially from this figure, the voltage tapings on the two mains transformers should be adjusted. - see page 21 for detailed instructions.

- (b) Connect the Noise Tube to the Power Unit by means of the cables provided which should be plugged in to sockets SKT.2 (High voltage B.N.C. type - anode connection) and SKT.3 (Polarised, 2-pin, screened - cathode and heater connection). These sockets will be found on the upper right hand side of the front panel.

N.B. The larger pin of the cathode socket is connected to earth. (chassis). If no load is connected, a train of high potential pulses will appear at the anode socket of the noise tube mount (or the connecting socket on the Power Unit if the cable is unplugged). This may result in a breakdown of insulation.

- (c) Ensure that rotary switches are set to the appropriate positions, (see paras B, C and D) with particular attention to S.5 (meter range).

B. D.C. Operation

- (a) Set S.4 (Tube V & I., +320 etc.,) to "Tube V & I".
- (b) Set S.1 (Heater volts) to the correct position for the Noise Tube connected. (1 amp max. load).
- (c) Set S.3 (D.C., 400 c/sec etc.,) to "D.C."
- (d) Set S.2 (Constant current range) to that appropriate for the Noise Tube connected.
- (e) Set S.5 (Meter range) to correspond with S.2 current.
- (f) Switch on S.6 (Mains toggle) and S.7 (H.T.) After a delay which allows for valve warm-up, the Noise Tube will automatically fire, the meter indicating the current taken by the tube.
- (g) After a minimum period of five minutes, adjust the appropriate pre-set current control to the current required. The Noise Source will now be ready for use, the Power Unit automatically stabilising the current to better than 2% of the pre-set value.
- (h) See para H. for faulty operation of auto-firing circuit.

C. Pulse operation

- (a) Set switches S.4, S.1, S.2 and S.5 as per para B (D.C. operation)
- (b) Set S.3 (D.C. 400 c/sec etc.,) to either 400 c/sec or 1 Kc/sec.

(c) Switch on S.6 (Mains toggle) and S.7 (H.T.). The Noise Tube will start automatically, after a delay for valve warm-up and will run at 400 c/sec or 1 Kc/sec with a mark/space ratio dependant upon the setting of VR.5, the meter indication being a function of the mark/space ratio and the Noise Tube recovery time characteristics. The latter being partially corrected by shaping the leading edge of the modulation pulse; ideally the meter indication with full modulation will be half the value set on D.C. operation.

(d) See para J for faulty pulse operation.

(e) Synchronisation

The square wave generator is a free-running multi-vibrator, which requires no triggering. If, however, it is desired to synchronise the Noise Tube pulses to external apparatus, this can be achieved either:

(i) by the injection of a trigger pulse of 2 to 10 volts amplitude +ve going into the "Sync.in" socket SKT.5 and setting the free running frequency to a slightly slower speed.

or

(ii) by using the "Square wave out" pulse of 60 volts peak to peak (+ & -ve going) from SKT.6 to trigger the external apparatus.

D. External modulation

(a) Set switches S.4, S.1, S.2 and S.5 as per para B (D.C. operation).

(b) Set S.3 (D.C. 400 c/sec etc.,) to "Ext. Mod."

(c) Inject a modulation signal of approximately 5 volts peak to peak into the "Ext.Mod." socket (SKT.7)

(d) Switch on S.6. (Mains toggle) and S.7 (H.T.). The tube will now modulate, the mark/space ratio being adjustable by front panel control VR.5.

E. Metering

(a) Ext. Current Meter

The wide scale non-parallax meter fitted to the unit has an accuracy of 1% of the scale reading at 200 and 125mA on the 250 and 150mA ranges, respectively, or appropriate positions on the type IM2 Power Unit meter. Provision is made for the use of an external meter (SKT.4) which enables a sub-standard meter to be used in series with the built-in meter, if required.

(b) Modulation monitoring facility.

A useful facility of the "ext.current meter" socket (SKT.4) is that since the socket is connected to earth (chassis) on one side, a $5\Omega\frac{1}{2}W$ resistor may be connected across a plug, inserted in SKT.4 and used for monitoring the modulation waveform of the tube current, by connection to an oscilloscope.

(c) Tube voltage measurement

This is measured by leaving S.4. (Tube V & I., +320 etc.,) in the "Tube V & I" position and switching meter range (S.5) to the appropriate voltage position. (See note on page 6)

(d) Internal voltage measurement. (S.3 set to "D.C.")

(i) +320v Set S.5. (Meter range) to 500v (1000v on type NM2), and S.4. (Tube V & I etc.,) to +320 and read on top scale.

(ii) +200v Set S.5 (Meter range) to 250v (300v on NM2) and S.4 (Tube V & I etc.,) to +200 and read on top scale. It should be noted that this voltage is dependant on the Noise Tube current and the tube voltage drop. It is advisable, therefore, to note the initial reading on your power unit when a particular Noise Tube is connected to avoid misinterpretation on future use. A table is provided below for this purpose.

(iii) -90v Set S.5. (Meter range) to 150v (100v on NM2) and S.4 (Tube V & I etc.,) to -90v and read on lower scale.

(e) Voltage Table for Power Unit type NM 1 Ser.No. 30

Tube type	Ser. No.	Tube voltage	Tube current	Internal vs.			Date
				+320	+200	-90	
NV1911	211	128	200	335	180	-86	20-1-66
NV2411	221	88	125	340	212	-86	

F. Neon filled Noise Tube operation on D.C.

(a) Some Neon filled Noise Tubes will be found to have a high voltage drop which may not permit the normal operation of the automatic tube firing circuit, since this relies on the voltage drop at L.L. to de-energise RL1. and so switch off the built-in multi-vibrator. In such a case this can be overcome by setting switch S.3 (D.C., 400 c/sec etc.,) to 1 Kc/sec and putting a short circuit on socket SKT6 (square wave out). This switches relay RL1 out of circuit and permits D.C. operation down to a certain minimum current which will depend on the Noise Tube voltage drop.

G. Cold cathode tube operation

Operation of cold cathode Noise Tubes will be as described in paragraphs A to F with the exception that the heater volts switch S.1 will be switched to the "off" position. Some Noise Tube manufacturers recommend that the heater volts be switched off after the tube has struck. Should the user wish to observe this routine S.1 (heater volts) should be switched off at the appropriate time, since there is no automatic switch incorporated in the unit to perform this function. On all "NORE MICROWAVE" hot cathode Noise Tubes it is recommended that the heater volts should be left on throughout operation, whether on D.C. or pulse conditions.

H. Unsatisfactory D.C. operation can be detected by either:

- (i) an audible 400c/sec note - or
- (ii) low current and unstable meter indication.
- (iii) Should either of the above conditions be observed, this may be due to one or more of the following causes:-

- (a) Tube voltage drop too high (see para 2F page 5)
- (b) Faulty Noise Tube
- (c) Open circuit connections to Noise Tube.

- (iv) If this condition is observed, the H.T. should be switched off immediately and the above points investigated.

J. Unsatisfactory Noise Tube Modulation.

Some noise tubes, notably short length Xenon filled tubes may have a very low maintaining voltage which can prevent full depth modulation. This condition can be combated by the inclusion of a resistor between the junction of V.9 anode and L.1 and SKT.2. The voltage drop across which will enable the voltage at the noise tube anode to be reduced by V.9 to a point at which ionisation will cease.

This facility is provided by the inclusion of a pair of high voltage stand-off insulators located on the top of heater transformer T.2. The shorting link should be removed and a resistor inserted.

K. Pre-set controls.

- (a) Mark/space ratio (VR.5)

This control is set initially to give a 50/50 mark/space ratio from the internally generated square wave modulator. A wide range of mark/space ratio can be achieved by adjustment of this control, the setting of which will not affect the automatic tube firing neither has it any effect on the internal modulation frequency.

- (b) Set 400 c/sec (VR.6)

This control is independent of both the "1Kc/sec" and "mark/space ratio" controls and is set initially to 400 c/sec. A wide range of adjustment is available.

- (c) Set 1Kc/sec (VR.7)

This control is independent of both the 400c/sec and mark/space ratio controls, is set initially to 1Kc/sec and also has a wide range of adjustment.

NOTE 1. To protect the meter against high voltage transients, the tube voltage measurement is taken from V.1 side of L.1, the indicated voltage thus includes the volt drop across L.1. To determine the actual tube voltage, the voltage drop across L.1 should be deducted from the indicated voltage. The D.C. resistance of L.1 is 40Ω.

NOISE TUBE POWER UNIT - TYPES NM.1 & NM.2

COMPONENT SPECIFICATION AND LOCATION

1. FIXED RESISTORS

Supplier: Radio Resistor Co.,

R. No.	Location	Value (ohms)	Wattage (w)	Tol. %	Type	Catalogue type
1.	T.P.1.A	1K	6	±5	W.W.	LG75
2.	T.P.1.C	20	6	±10	W.W.	"
3.	T.P.1.C	20	6	±10	W.W.	"
4.	T.P.4.B	1K	6	±5	W.W.	"
5.	T.P.4.B	6.8K	14	±5	W.W.	LG134
6.	T.P.4.B	6.8K	14	±5	W.W.	"
7.	T.P.4.A	1.1K(2.7K NM2)	12	±5	W.W.	"
8.	T.P.4.A	2.2K	14	±5	W.W.	"
9.	T.P.4.A	10K	14	±5	W.W.	"
10.	T.P.2.C	30K	$\frac{1}{2}$	±2	Hi-stab	2HS3
11.	T.P.2.B	20K	$\frac{1}{2}$	±2	"	"
12.	T.P.2.C	30K	$\frac{1}{2}$	±2	"	"
13.	T.P.2.B	15K	$\frac{1}{2}$	±2	"	"
14.	T.P.2.C	30K	$\frac{1}{2}$	±2	"	"
15.	T.P.2.B	5.6K	$\frac{1}{2}$	±2	"	"
16.	T.P.3.B	1.2 Meg	1	±10	Carbon	5SCD4
17.	X.3.C	1K	$\frac{1}{2}$	±10	"	5SCD3
18.	X.3.C	27	1	±10	"	5SCD4
19.	X.3.B	27	1	±10	"	5SCD4
20.	X.3.B	120	$\frac{1}{2}$	±10	"	5SCD3
21.	X.3.B	120	$\frac{1}{2}$	±10	"	5SCD3
22.	X.3.B	1K	$\frac{1}{2}$	±10	"	5SCD3
23.	X.3.C	1K	$\frac{1}{2}$	±10	"	5SCD3
24.	T.P.3.B	68K	2	±10	"	5SCD4
25.	X.3.C	1K	$\frac{1}{2}$	±10	"	5SCD3
26.	T.P.1.C		2	±10	"	5SCD5
27.	T.P.4.A	2.7K	12	±5	W.W.	LG75
28.	T.P.3.C	22K	$\frac{1}{2}$	±2	Hi-stab	2HS3
29.	T.P.3.C	47K	$\frac{1}{2}$	±2	"	"
30.	T.P.3.C	470K	$\frac{1}{2}$	±2	"	2HS3
31.	T.P.2.C	200	14	±5	W.W.	LG134
32.	T.P.2.C	300	14	±5	W.W.	LG134
33.	T.P.2.C	470	14	±5	W.W.	LG134
34.	T.P.6	Meter shunt for 250mA meter range or 300mA on NM2				
35.	T.P.6	Meter shunt for 150mA meter range or 100mA on NM2				
36.	T.P.6	(500K - NM1) (500K+500K - NM2)	1	±2	Hi-stab	2HS3
37.	T.P.6	(250K - NM1) (150K+150K - NM2)	0 $\frac{1}{2}$	±2	"	"
38.	T.P.6	(150K - NM1) (100K - NM2)	$\frac{1}{2}$	±2	"	"
39.	T.P.2.B	39K	$\frac{1}{2}$	±10	"	5SCD3
40.	T.P.2.A	1.8K	$\frac{1}{2}$	±10	"	5SCD3
41.	T.P.2.A	1 Meg	$\frac{1}{2}$	±10	"	"
42.	T.P.2.A	39K	$\frac{1}{2}$	±10	"	"
43.	T.P.2.A	820	$\frac{1}{2}$	±10	"	"
44.	T.P.2.A	1.2K	$\frac{1}{2}$	±10	"	"
45.	T.P.3.A	120K	$\frac{1}{2}$	±10	"	"
46.	T.P.3.A	10K	$\frac{1}{2}$	±10	"	"
47.	T.P.3.A	820	$\frac{1}{2}$	±1	"	2HS3
48.	T.P.3.A	390	$\frac{1}{2}$	±2	"	"
49.	T.P.3.A	4.7K	1	±2	"	2HS4
50.	X3.B	1K	$\frac{1}{2}$	±10	Carbon	5SCD3
51.	T.P.3.B	220K	$\frac{1}{2}$	±2	Hi-stab	2HS3
52.	X3.B	1K	$\frac{1}{2}$	±10	Carbon	5SCD3
53.	T.P.3.B	220K	$\frac{1}{2}$	±2	Hi-stab	2HS3
54.	T.P.3.B	5.6K	1	±2	"	2HS4
55.	T.P.3.B	1.2K	$\frac{1}{2}$	±2	"	2HS3

1. FIXED RESISTORS (Cont'd.) (Suppliers - Radio Resistors Ltd.,)

R. No.	Location	Value (ohms)	Wattage (w)	Tol. %	Type	Catalogue type
56.	T.P.5	82K	$\frac{1}{2}$	± 2	Hi-stab	2HS3
57.	T.P.5	10K	$\frac{1}{2}$	± 2	"	"
58.	T.P.5	95K	$\frac{1}{2}$	± 2	"	"
59.	X.2.C	1 Meg	$\frac{1}{2}$	± 10	Carbon	5SCD3
60.	T.P.2.B	33K	$\frac{1}{2}$	± 5	W.W.	LG138
61.	X.2.B	1K	$\frac{1}{2}$	± 10	Carbon	5SCD3
62.	T.P.5	20K	$\frac{1}{2}$	± 2	Hi-stab	"
*63.	T.P.2.C	47K & 56K	$\frac{1}{2}$	± 2	"	2HS3
*64.	T.P.2.B	15K	$\frac{1}{2}$	± 2	"	2HS3
*65.	X.3C	120	$\frac{1}{2}$	± 10	Carbon	5SCD3
*66.	X.3.C	27	1	± 10	"	5SCD4
*67.	X.3.C	1K	$\frac{1}{2}$	± 10	"	5SCD3
*68.	T.P.2.C	300 & 200 ϕ	14	± 10	W.W.	LG134
*69.	X.1.B	39K ∇	$\frac{1}{2}$	± 2	Hi-stab	2HS3
70.	T.P.3.C	820	2	± 10	Carbon	5SCD4
71.	T.P.1.A	120K	$\frac{1}{2}$	± 10	Hi-stab	5SCD3
72.	T.P.1.A	1 meg	$\frac{1}{2}$	± 10	"	5SCD3
73.	T.P.1.A	120K	$\frac{1}{2}$	± 10	"	5SCD3
74.	T.P.1.A	3.3K	$\frac{1}{2}$	± 10	"	5SCD3
75.	X.3.B	1 Meg	$\frac{1}{2}$	± 10	"	5SCD3
76.	T.P.3.C	100K	$\frac{1}{2}$	± 10	Carbon	5SCD3
77.	T2	10	$\frac{1}{2}$	± 10	"	5SCD3

* NM2 only ∇ in parallel with VR8 ϕ in parallel

2. VARIABLE RESISTORS

V.R. No.	Location	Value (ohms)	Wattage (w)	Tol. %	Type	Supplier
1.	X.1.B	20K	1	± 10	C1	Reliance Control
2.	X.1.B	20K	1	± 10	C1	"
3.	X.1.B	20K	1	± 10	C1	"
4.	1C	50K	1	± 10	C1	"
6.	X.2.C	20K	1	± 10	C1	"
7.	X.2.B	20K	1	± 10	C1	"
*8.	X.1.B	20K ∇	1	± 10	C1	"

* NM2 only ∇ in parallel with R69

3. CAPACITORS

C. No.	Location	Value (μ FD)	Volts working	Tol. %	Type	Supplier
1.						
2.	X.1.A	*125	450	(	ER51/S	C.C.L.
3.	X.1.C	*32	500	+50	CTE0201	Dubillier
4.	T.P.4.A	*8	450	-20	CE4167/21	Plessey
5.	X.1.C	*100	350	(	KEQ411	Hunts
6.	X.1.B	*32	500		CTE0201	Dubillier
7.	T.P.4.A	.1	160	± 10	C296AA-A100K	Mullard
8.	T.P.4.B	*500	25	+50 -20		Radiospares
9.	T.P.3.C	.22	125	± 10	C296AA-A220K	Mullard
10.	X.1.A	.1	400	± 10	C296AC-A100K	"
11.	T.P.2.B	.15	400	± 10	C296AC-A150K	"
12.	T.P.2.A	.15	400	± 10	C296AC-A150K	"
13.	T.P.2.A	.47	125	± 10	C296AC-A470K	"
14.	T.P.3.A	.001	500	(+50 -25	Ceramic	Radiospares
15.	X.2.B	.047	400	± 10	C296AC-A47K	Mullard
16.	T.P.3.A	(.0036 + .0047	500	± 1	Silvered mica	Radiospares
17.	T.P.3.B	(.0036 + .0047	500	± 1	"	"

* Electrolytic

3. CAPACITORS (Cont'd.)

C. No.	Location	Value (μ FD)	Volts working	Tol. %	Type	Supplier
18.	T.P.2.B	.1	400	± 10	{ AA.A160K	Mullard
19.	Z.2.A	.1	400	± 10		"
20.	T.P.3.B	* 8	450		CE4167/21	Plessey
21.	X.3.B	.001	250	± 10	Paper	Radiospares
22.	T.P.1.A	.1	250	± 10	"	"
23.	T.P.1.A	* 50	12	± 50 -20	ME52S	C.C.L.

* Electrolytic

4. VALVES

V. No.	Location	C.V.Equivalent	Type	Supplier
1.	X.3.C	CV1741	EL34	Mullard
2.	X.3.B	CV1741	EL34	"
3.	X.2.C	CV4020 (nearest)	150C4	"
4.	X.2.C	CV5173	90C1	"
5.	X.3.C	-	ECF82	"
6.	X.2.C	CV5173	90C1	"
7.	X.3.B	CV455 (nearest)	12AT7	"
8.	X.2.B	CV455 (nearest)	12AT7	"
9.	X.3.C	CV5830	EL360	"
10.	X.2.B	CV455 (nearest)	12AT7-	"
11.*	X.3.C	CV1741	EL34	"
12.	X.3.B	CV455 (nearest)	12AT7-	"

* NM2 only

5. SEMI-CONDUCTOR DIODES.

D. No.	Location	Type	Supplier
1.	T.P.1.A	SJ.803-E	A.E.I.
2.	T.P.1.A		
3.	T.P.1.A		
4.	T.P.1.A		
5.	T.P.1.B		
5.	T.P.1.B		
6.	T.P.1.B		
7.	T.P.1.B		
8.	T.P.1.B		
9.	T.P.1.B		
10.	T.P.1.B		
11.	T.P.1.C		
12.	T.P.1.C		
13.	T.P.1.C.		
14.	T.P.1.B		
15.	T.P.1.B		
16.	T.P.1.B		
17.	T.P.3.C		
18.	T.P.3.A	O.A.5 x 2	Mullard
19.	T.P.4.B	SJ.803-E	A.E.I.

6. FUSES

F. No.	Location	Value (Δ)	Type	Supplier
1.	Z.I.D	1.0 *	Glass 1 $\frac{1}{4}$ " long	) Belling Lee, Radiospares
2.	Z.I.D	2.0 ϕ $\pm$		
3.	Y.3.D	.1		
4.	Y.3.D	.1		
5.	Y.3.D	.5 (Anti-surge)		
6.	Y.3.D	.1		
* 2.0 for 110v operation. ϕ 3.0 for 110v operation $\pm$ 3A in NM2				

7. RELAYS

RL No.	Location	Resistance ohms	Contacts	Supplier
1.	X.1.A	4K	2.N/O	} Magnetic Devices
2.	Y.1.A	8.5	1.N/O 1.ch/over	

8. TRANSFORMERS

T. No.	Location	Details	Type	Supplier
1.	Y.2.D	See Circuit diagram	50-28	} Ashgrove Instruments
2.	Y.2.A		30-17	

9. INDUCTORS

L. No.	Location	Details	Supplier
1.	Y.3.A	2.5H Insulated to 6KV. 350mA	Ashgrove Instruments

10. SWITCHES

S. No.	Location	Details	Supplier
1.	Z.2.A	Rotary - 1 pole 6way	} A.B.Metals Ltd.,
2.	Z.2.C	Rotary ceramic 3 pole 3 way *	
3.	Z.2.B	Rotary ceramic 5 pole 4 way	
4.	Z.1.B	Rotary ceramic 3 pole 4 way	
5.	Z.1.D	Rotary ceramic 2 pole 5 way	} R.T.S.
6.	Z.2.D	Toggle 2 pole on/off	
7.	Z.2.C	Toggle 1 pole ON/OFF	
	* 4 way on NM2		"

11. SOCKETS

SKT. No.	Location	Type	Details	Supplier
1.	X.1.A	P.429	3A.250V 3pin Mains I/P)	Bulgin
2.	Z.1.A	UG931/U	* High volts BNC type	SASCO
3.	Z.1.A	CD.072/POL	Twin, screened	Transradio
			* polarised	
4.	Z.2.C	P.73	Ext. current meter jack	Brookhirst Igranico
5.	X.1.D	83U.H.F.	Sync.input	Greenpar Eng.
6.	X.1.D	83U.H.F.	Square wave out	"
7.	Z.2.A	83U.H.F.	External mod.	"
* Noise Tube connectors				

12. THERMAL DELAY

Location	Type	Details	Supplier
Y.1.A.	L.413/1A/3/6.3v	Auto-resetting	Belling Lee

13. PILOT LAMP

Location	Rating	Details	Supplier
Z.1.D	6.5v 1w	4mm diam. bulbLES cap	Radiospares

14. METER

Location	Rating	Details	Type	Supplier
Z.1.B	1mA F.S.D.	4½" mirror scale	2705	Nore Microwave

15. MISCELLANEOUS PARTS

Item	Details	Type	Supplier
Pilot lamp holder	L.E.S. panel mounting, red	-	Radiospares
Fuse holders	For F.1 and F.2 enclosed panel mounting type	L.1348	Belling & Lee
Fuse holders	For F.3,4,5 and 6 chassis mounting, open type	L.510	Belling & Lee
Valve holders	For V.1, V.2, V.9 and V.11 Internation octal	79/921M	Carr Fasteners Ltd.,
Valve holders	For V.3, 4 and 6 B.7G	77/630M	"
Valve holders	For V.5, 7, 8, 10 & 12 B.9A	77/631M	"
Valve retainers	For V4,5,6,7,8,10 & 12	VRA.6	Electro-Thermal Ltd.,
Valve retainer	For V.9	E.3290	The Lewis Spring Co.,
Valve retainer	For V.3	VRA7	Electro-Thermal Ltd.,
Valve top cap connector	For V.9	P.3229	Bulgin
Pre-set control locks	Flush type	F.L.101.C	P.F.Fox Ltd.,
Control knobs	Black, indexed	X.7	Merriott Mouldings Ltd.,
Stand-off Insulators	Standard	-	Radiospares
Stand-off Insulators	High voltage	W.4041	Harwin Engineering Ltd.,
Tag strips	For tag panels TP.1,2,3,4.	-	Radiospares
Tag panels	" " " T.P.5 and 6	-	"
Case	Finish in blue hammertone	605	Imhoff
Feed through Insulators	P.T.F.E. insulation	P.T.2.	A.E.I.
Jack Plug	Ext. Metering	P.40	Brookhirst Igranio
Mains Plug	Ministure 3-pin	P.429	Bulgin
Noise tube Plug (Cathode)	Twin, polarised	GDO72/POL	Transradio
Noise tube plug (Anode)	High voltage insulation	UG932A/U	SASCO

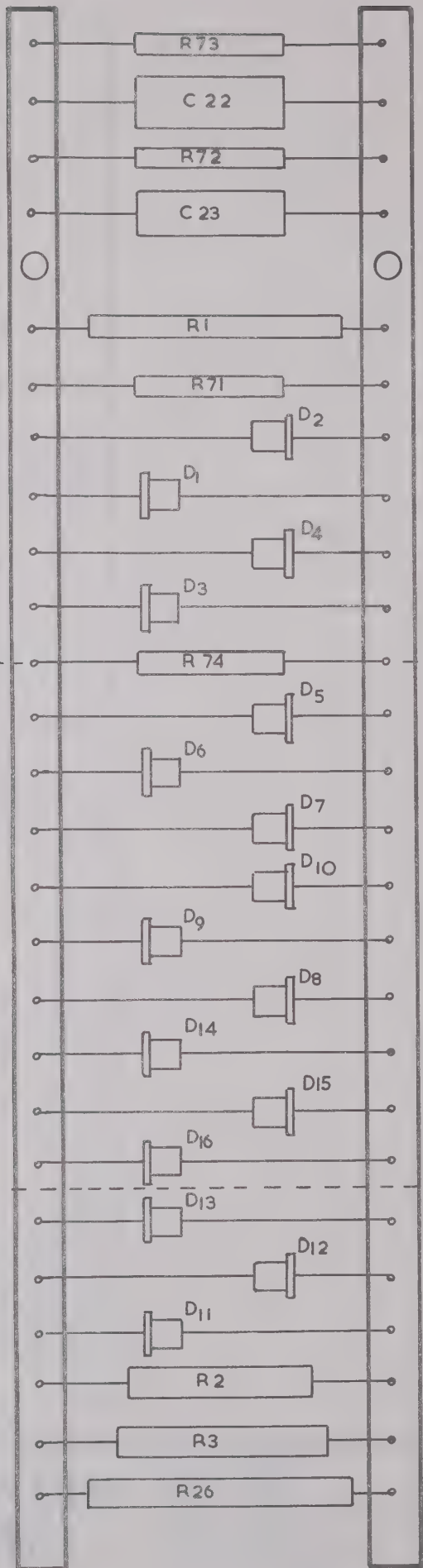
LIST OF SUPPLIERS

A. B. Metals, North West House, 119-127, Marylebone Road, London N.W.1.
A.E.I., 33, Grosvenor Place, London S.W.1.
Ashgrove Instruments Ltd., 96, Amyland Park Road, Twickenham, Middx.
Belling & Lee, Cambridge Arterial Road, Enfield, Middx.
Brookhirst Igranic, Bedford Works, Bedford.
A. F. Bulgin & Co., Bye-pass Road, Barking, Essex.
C.C.L., Hanworth Lane, Chertsey, Surrey.
Dubilier Condensor Co., (1925) Ltd., Victoria Road, North Acton, London W.3.
Elliott Bros., Century Works, London S.E. 13.
P.X. Fox Ltd., 12-15, Bowlers Croft, Basildon, Essex.
Greenpar Engineering Ltd., Harlow, Essex.
Harwin Engineering Ltd., Fitzherbert Road, Farlington, Hants.
A. H. Hunt (Capacitors) Ltd., Bendon Valley, Garratt Lane, London S.W. 18.
Magnetic Devices, Exning Road, Newmarket, Suffolk.
Marriott Mouldings Ltd., Tail Mill, Merriott, Somerset.
Mullard Ltd., Mullard House, Torrington Place, London W.C.1.
Plessey Ltd., Capacitor Dept., Kembrey Street, Swindon, Wilts.
Radiospares Ltd., 4-8, Maple Street, London W.1.
Radio Resistor Co. Ltd., 9-11, Palmerston Road, Wealdstone, Harrow Middx.
Reliance Controls Ltd., Sutherland Road, Higham Hill, London E.17.
R.T.S., P.O. 11, Gloucester Street, Cambridge.
SASCO., Nutfield, Redhill, Surrey.
Transradio, 138A, Cromwell Road, London S.W.7.

A

B

C

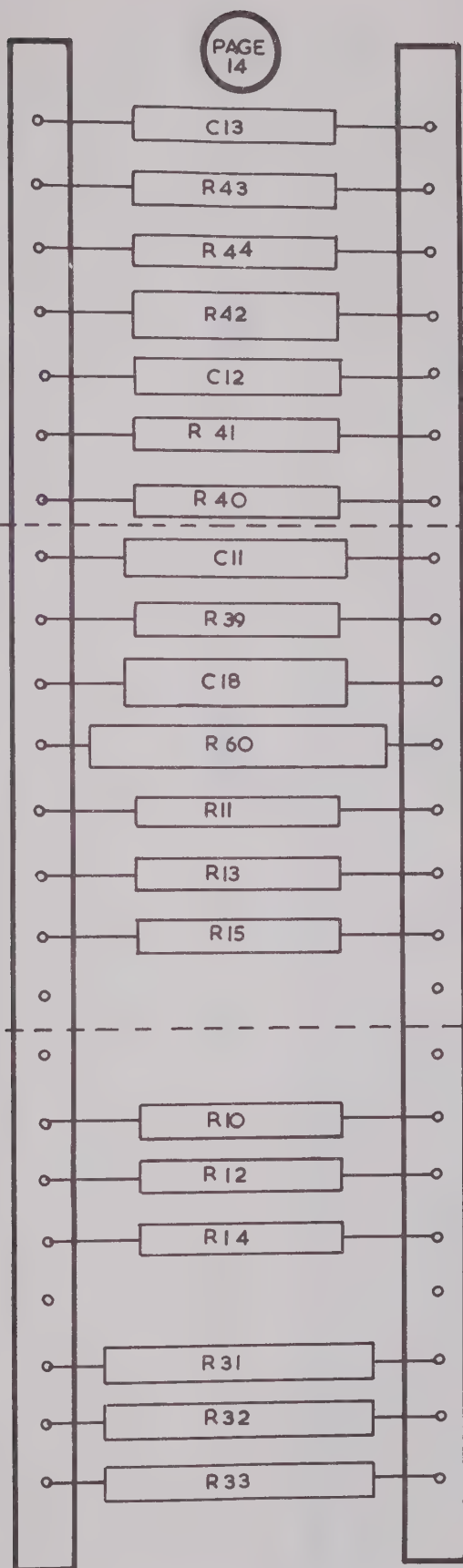


DRG. No. 691/2	
ISSUE	CHANGE
2	21.5.65 VI2 COMPONENTS ADDED
NOISE TUBE POWER UNIT TYPE NMI & 2 CHASSIS TAG PANEL No.1	
MAT.	DRN. <i>[Signature]</i>
SCALE.	CHKD. <i>[Signature]</i>
DATE. 8.9.64	APPD. <i>[Signature]</i>

A

B

C



DRG. No.
692/2

NOISE TUBE POWER UNIT
TYPE NMI

CHASSIS TAG PANEL

No. 2

DRN

CHKD

APPD.

SCALE

DATE 8-9-64

ISSUE

CHANGE

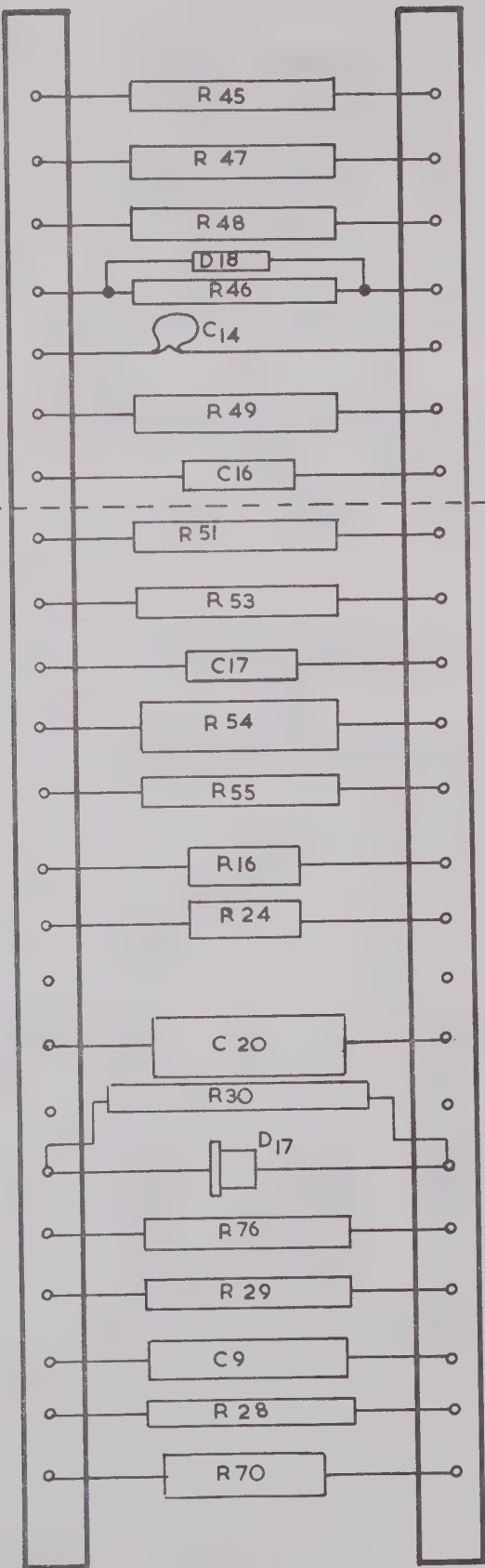
2

21-5-65
C13 ADDED

A

B

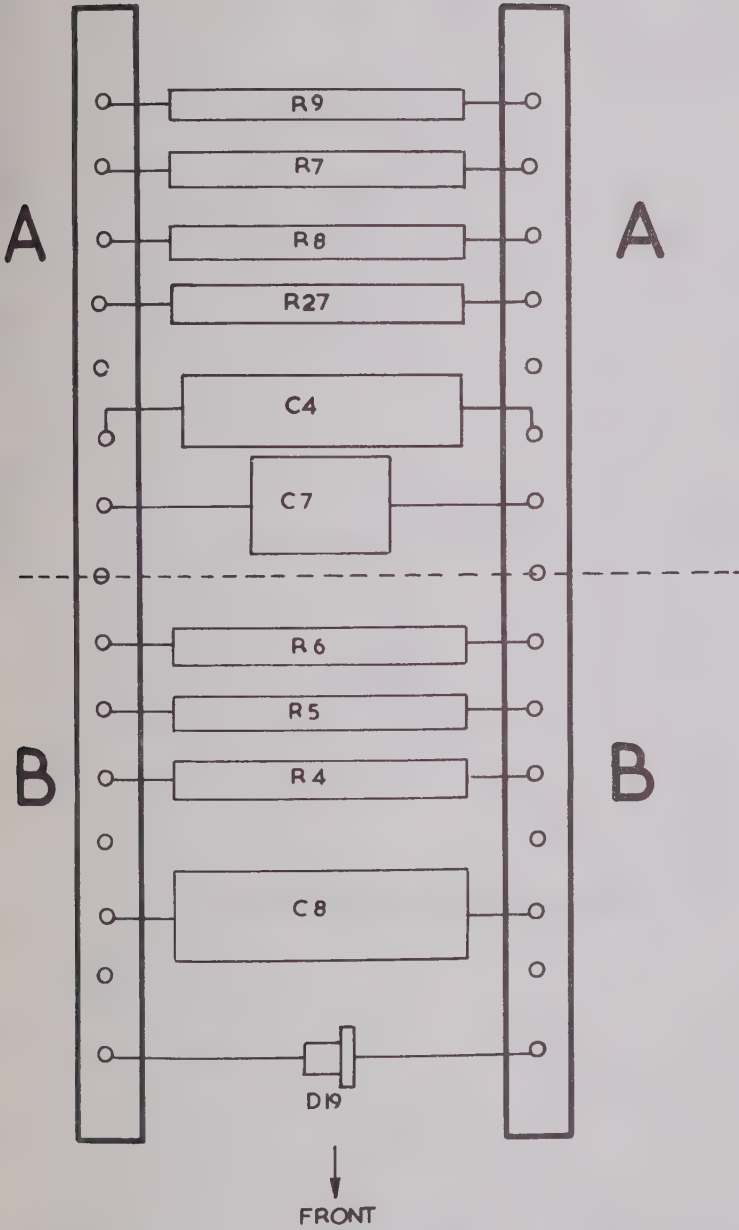
C



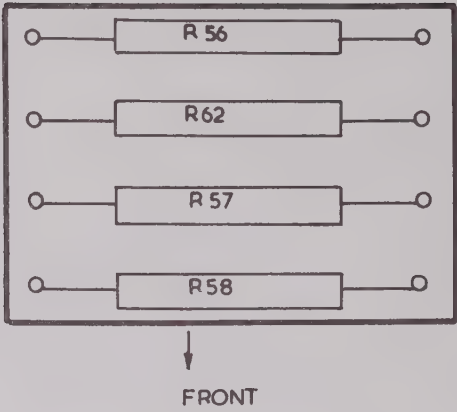
DRG. No. 693/2		NOISE TUBE POWER UNIT TYPE NM1&2 CHASSIS TAG PANEL No.3	DRN. <i>SP</i>
ISSUE	CHANGE		CHKD. <i>SP</i>
2	21.5.65 DECOUPLING COMPONENTS ADDED		APPD. <i>SK</i>
			SCALE
			DATE 8.9.64

NORE MICROWAVE

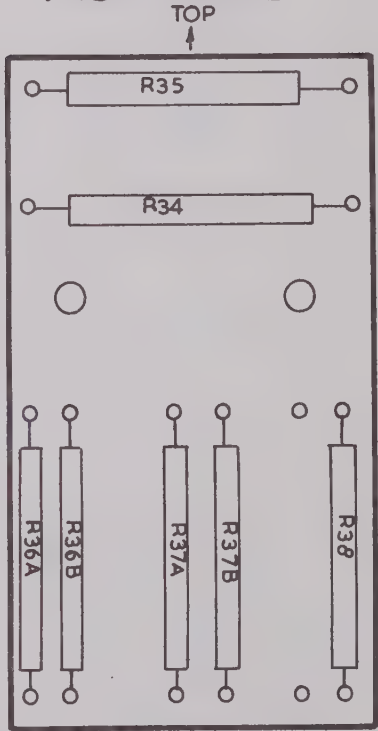
TAG PANEL 4



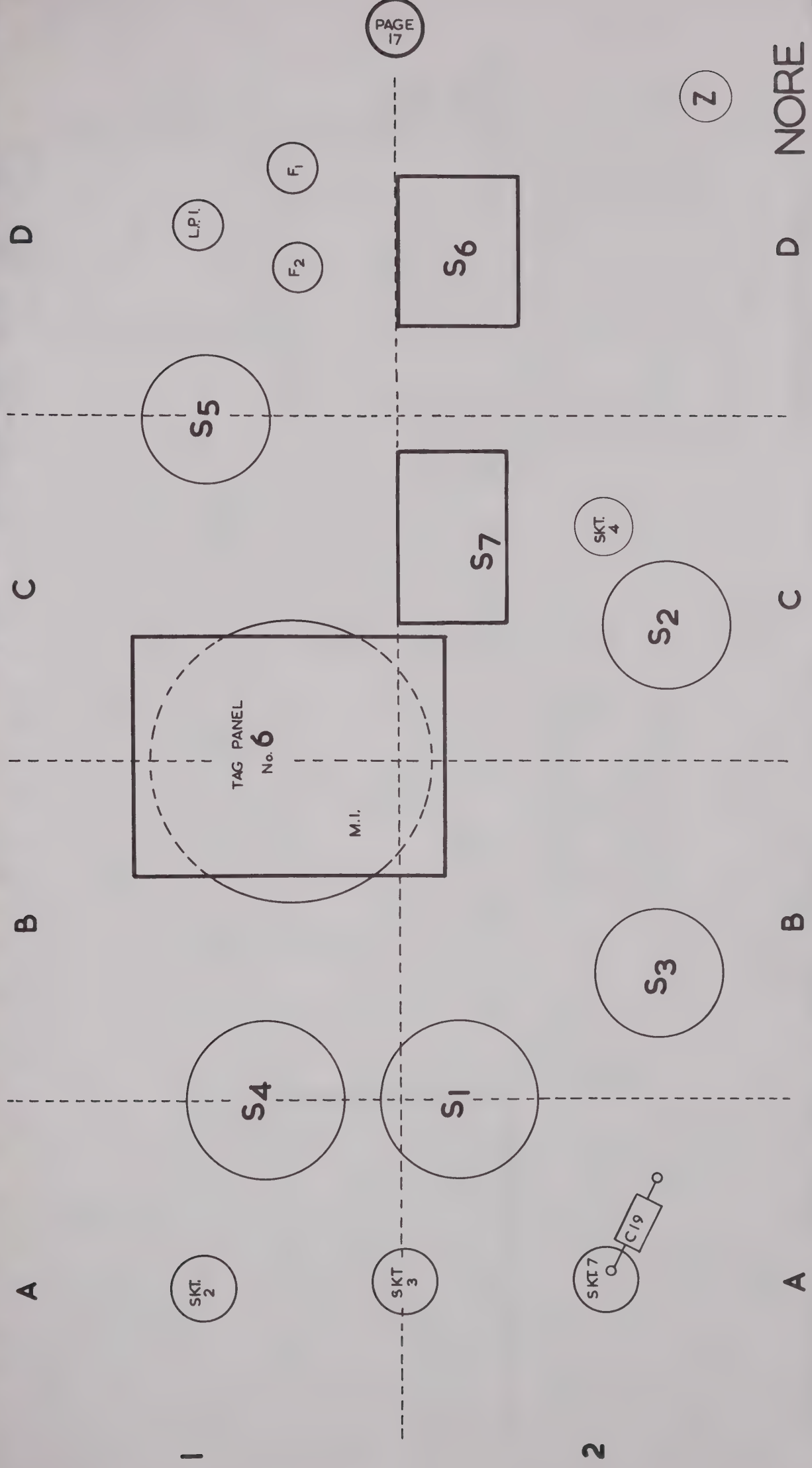
TAG PANEL 5



TAG PANEL 6



DRG. No. 565/3		TAG PANELS FOR NMI & NM2 (4, 5 & 6)	DRN. <i>[Signature]</i>
ISSUE	CHANGE		CHKD <i>[Signature]</i>
3	21-5-65 R27 ADDED TO TP4		APPD <i>[Signature]</i>
			SCALE
			DATE 14 · 11 · 64



PAGE 17

NORE MICROWAVE

FRONT PANEL LAYOUT VIEWED FROM REAR

CHKD. *[Signature]* APPD. *[Signature]*

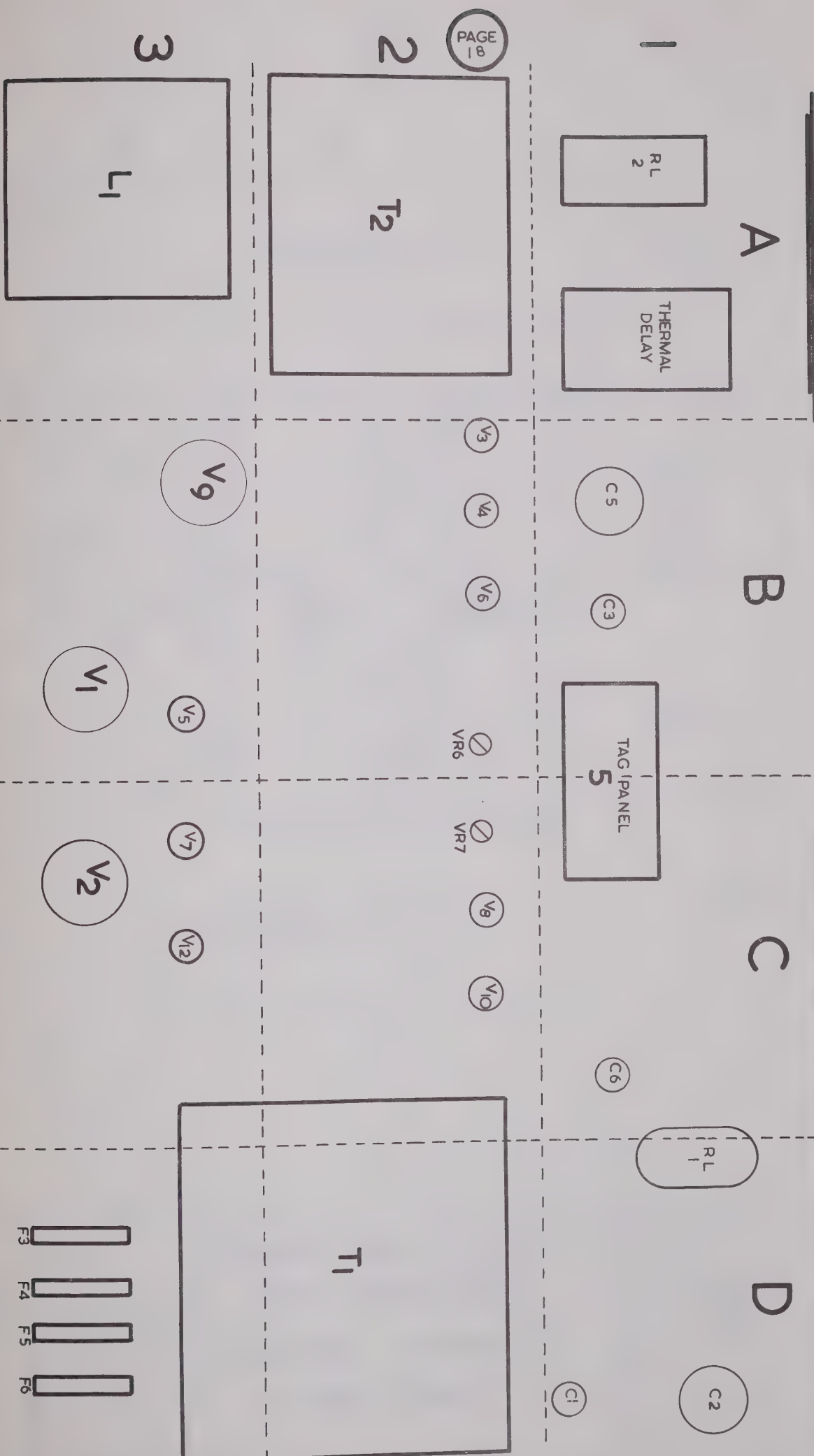
DRN. *[Signature]*

DRG. No. 704/2
21.5.65

CHASSIS LAYOUT 'Y' (TOP VIEW)

FRONT PANEL

NOISE TUBE POWER UNIT TYPE NM1

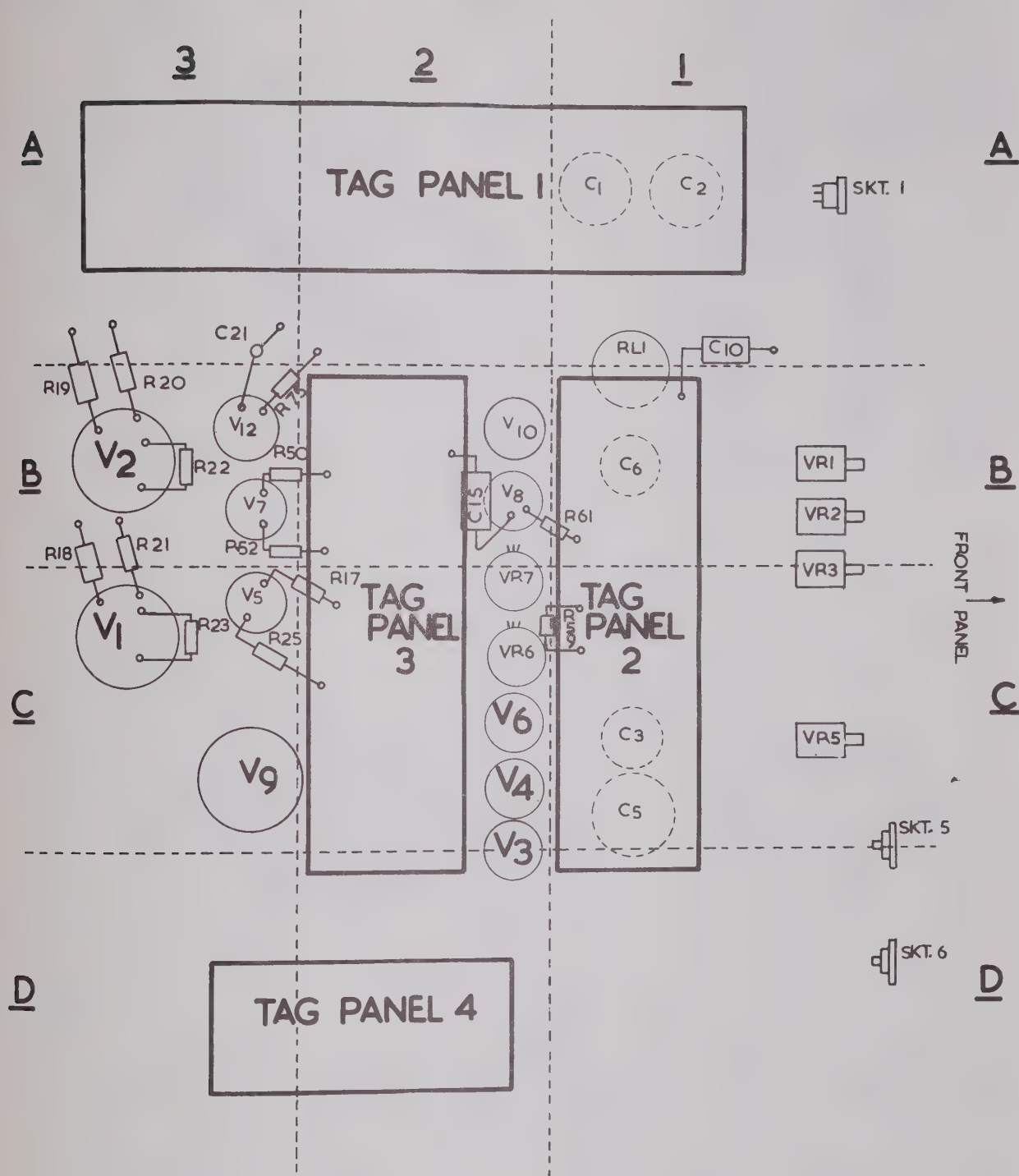


NORE MICROWAVE

DRN. *[Signature]*

CHKD. *[Signature]*

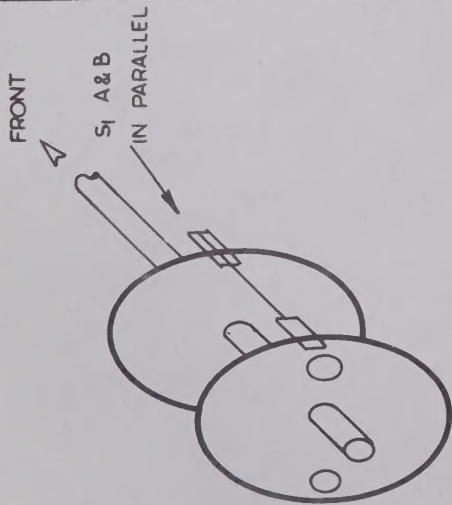
APPD.



DRG No. 564/2		NOISE TUBE POWER UNIT TYPE NMI CHASSIS LAYOUT 'X' LOWER VIEW		DRN. <i>[Signature]</i>
ISSUE	CHANGE			CHKD. <i>[Signature]</i>
2	21/5-65 V12 ADDED			APPD. <i>[Signature]</i>
				SCALE
				DATE 11 · 11 · 64

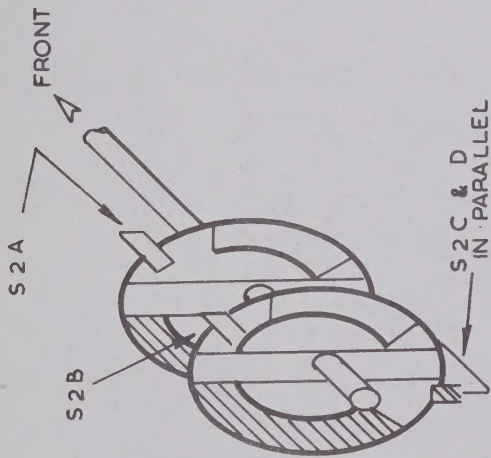
HEATER VOLTS

S₁



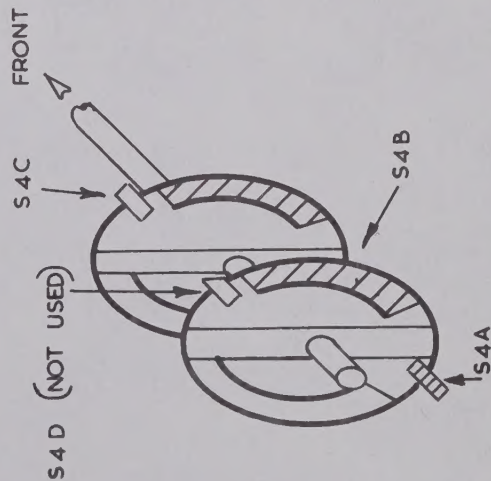
CONSTANT CURRENT RANGE

S₂



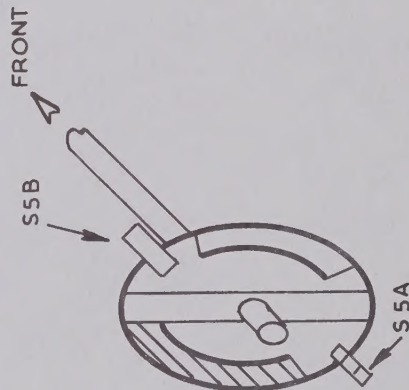
TUBE V & I & INTERNAL

S₄



METER RANGE

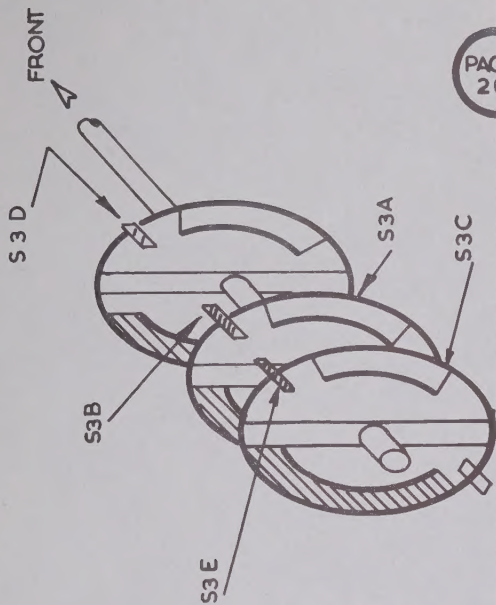
S₅



PAGE
20

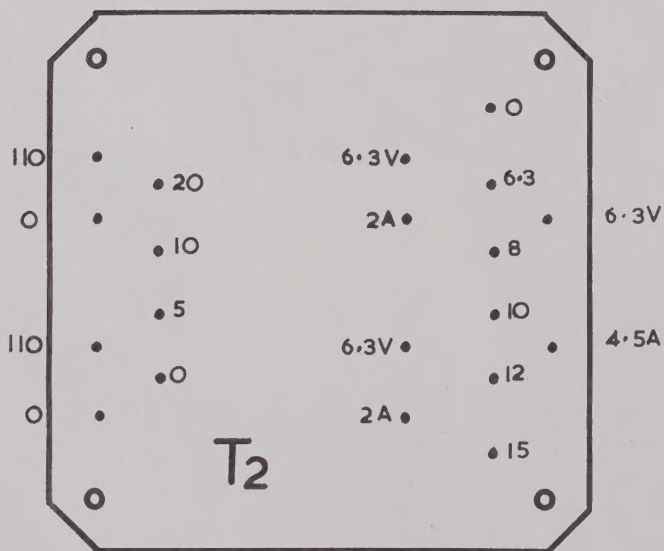
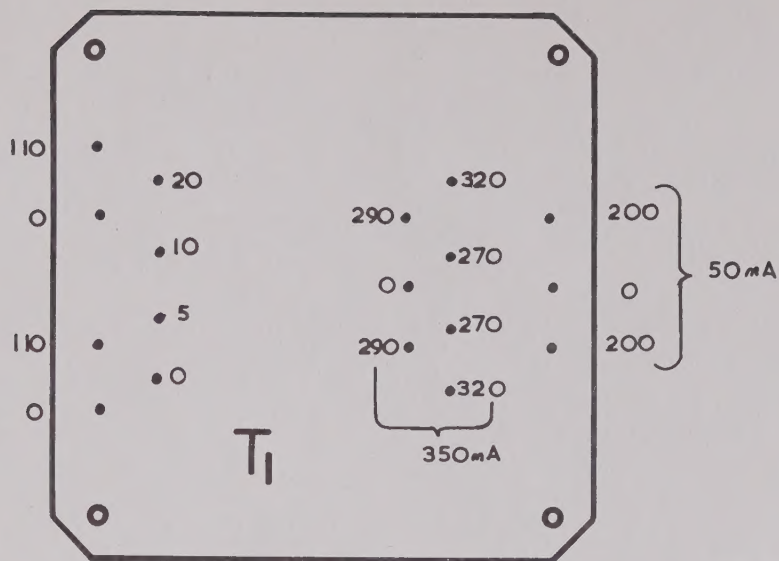
D.C. 400 C/SEC ETC.

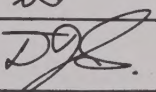
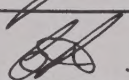
S₃



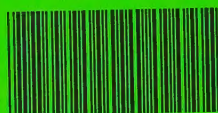
ROTARY SWITCH DETAIL NMI & NM2

ISSUE	CHANGE	DRG. No.	706/2
2	21-5-65 S3E ADDED	DRN.	<i>dt</i>
		CHKD	<i>dt</i>
		APPD.	<i>dt</i>
		SCALE	
		DATE	14-11-64



DRG. No. 779/1		TRANSFORMER CONNECTIONS NMI & NM2	DRN 
ISSUE	CHANGE		CHKD 
			APPD 
			SCALE
			DATE 21 · 5 · 65

MP MASTER



MA24692